CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the potential direct, indirect, and cumulative effects of the Proposed Action (Chapter 2) and No Action alternatives. Potential direct and indirect impacts could result from the Project. Cumulative effects are those impacts that could result from combining the impacts of the Proposed Action with past, present, and reasonably foreseeable future actions.

This chapter also describes unavoidable adverse effects (those effects that remain after implementation of mitigation measures) and the relationship between short-term uses of resources and long-term productivity.

Irreversible or irretrievable commitments of resources that could result are also described. Irreversible commitments are those that cannot be reversed except over a very long period of time. Irretrievable commitments are those that are lost for a shorter period.

Reasonably Foreseeable Actions

Several actions are currently under way or will be conducted at the RML campus over the next few years. These activities are independent of the Proposed Action; however, implementation of these actions will affect the Project site. These actions, shown in **Figure 4-1**, are as follows:

- With the exception of the outer six-foot chain link fence on the south side of the RML property, all other existing fence will be replaced with black steel fence surrounding the entire site. This is in compliance with new NIH security guidelines;
- The entrance at 4th and Grove will be moved north to be offset from Grove Street. Staff will enter here and pass through an entrance manned with security guards or NIH police officers 24 hours a day, 7 days a week. A landscaped security barrier (natural materials such as boulders, earth, and vegetation) will be incorporated at 4th and Grove;
- A planned central shipping and receiving building (undetermined size) at the northeast corner of the campus near the north gate will be built for receiving and shipping goods. It will be equipped with an X-ray machine and other security screening devices. Once construction is complete, material delivery will be through the north gate. All commercial delivery vehicles will undergo a vehicle inspection before entering the RML facility. A loading dock will be present at this site, and deliveries will be off-loaded here and transported around campus by RML staff. Commercial delivery trucks would not be allowed to drive around on campus with the possible exception of animal deliveries;
- The fence on the north side of campus will be replaced with the black steel fencing under Phase 2 of the Fence Upgrade Project;
- A visitor's center will be constructed north of the existing guard station and gate to provide information, security screening of visitors, and a meeting area for visitors and RML staff. All visitors conducting business on the RML campus will have their person and personal belongings screened at the visitor center before accessing the RML campus. A special parking area will be provided for visitors where vehicles will be screened;
- A new employee parking lot will be constructed on the north side of the site;
- A new storage building may be constructed in the southwest corner of the campus;
- A silencer has been installed on the incinerator to reduce noise. A project to further reduce the noise on the incinerator cooling tower and the Building 27 load bank is currently under design;
- Roads (shown on Figure 4-1) will be paved; and
- Trees, grass, and other vegetation will be planted inside the paved road on the perimeter of the campus.

4.2 SOCIAL RESOURCES

4.2.1 Direct and Indirect Effects

4.2.1.1 Proposed Action

Population and Demographic Trends

Additional employment from the proposed Integrated Research Facility includes up to 200 workers at the peak of the construction phase, and up to 100 employees phased in over several years following the opening of the facility. If the Proposed Action were to be selected, the number of new residents who would move to Ravalli County and the City of Hamilton would represent a small portion of the anticipated population increase that is expected to occur regardless of the inducement of the Proposed Action. If all new employees were new residents of the county, chose to live in Ravalli County, and had household sizes that matched the Ravalli County rate of 2.48 persons per household, the Proposed Action would add about 248 new residents. These residents would be added to both the low and high projection of 8,000 and 18,000 new people expected as the result of net in-migration by 2010. The population increase from construction of the Integrated Research Facility (248 people) represents 1.4 to 3 percent of the total projected increase in county residents.

The age structure of the county's population has changed during the period of rapid growth (1990-2000), and Integrated Research Facility-related newcomers are expected to more closely match the new population than the historic population. No impact is expected on the ethnic or gender make-up of the population. Most jobs created by the Proposed Action would require skilled and experienced, mature workers. Average education levels in Ravalli County and Hamilton may increase slightly as a result of the additional staff at RML.

Housing

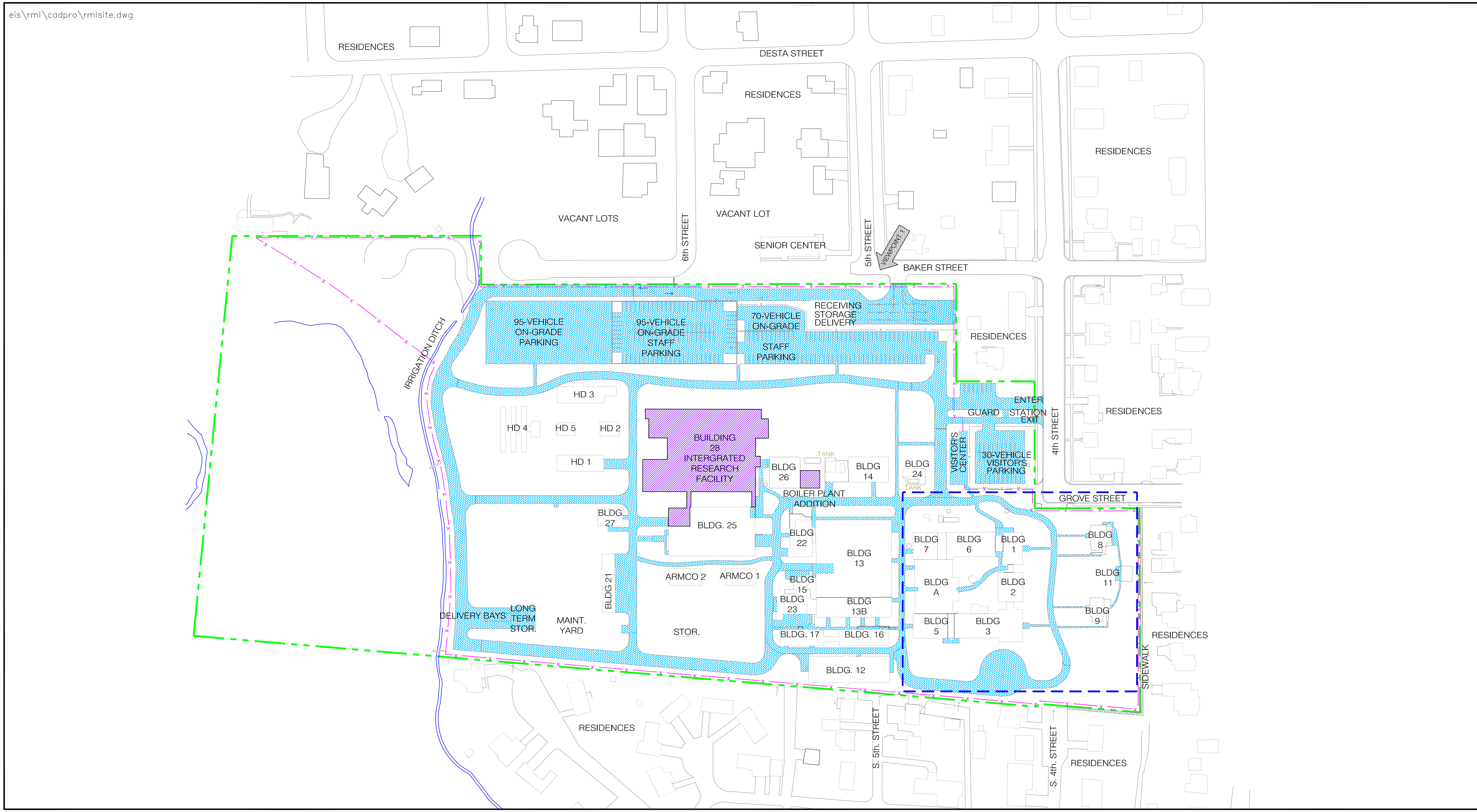
The neighborhood adjacent to RML may encounter direct negative impacts during construction of the Integrated Research Facility if the Proposed Action were selected. Construction is estimated to take two years, during which time trucks would access the property and equipment would be operating.

To evaluate potential impacts to property values, an evaluation of value trends for residential property adjacent to BSL-4 laboratories in other locations was completed. The information suggests that construction and operation of BSL-4 laboratories in residential areas does not result in lowering of property value. The value of residential property adjacent to the Centers for Disease Control (CDC) BSL-4 laboratory in Atlanta, Georgia, has increased over its operational history (Rollins 2003). The surrounding up-scale residential area has townhouses valued between $300,000 and $500,000, and homes selling for over $700,000. Bowers (2003) also reported that property values in the area surrounding a BSL-4 facility in Galveston, Texas have not declined. In Winnipeg, Manitoba, property values have remained consistent with the surrounding mixed-use area despite the development of a BSL-4 laboratory (Halladay 2003).

Property values in the proposed Integrated Research Facility area and prices of property adjacent to RML in Hamilton are stable. Houses do not remain on the market longer than normal since the Proposed Action was discussed at the June DEIS public meeting (Dowling 2003, Polumsky 2003, Rose 2003). Housing prices in the neighborhood are $20,000 to $30,000 higher than in other sections of Hamilton (Dowling 2003).

Based on population projections and numbers of people per household unique to Hamilton, between 335 and 900 new housing units would be needed by 2010 to accommodate projected new growth in the community. While it is unknown whether all new RML employees would move to Hamilton, the number of projected new homes is sufficient to house them.

Housing construction is a thriving industry in Ravalli County. The number of new homes required by Integrated Research Facility-related growth would support that industry. Housing prices in the county continue to increase faster than wages. Addition of new homes would result in an increase in business for homebuilders and real estate developers. The increase in population as a result of the Proposed Action would not require special mitigation actions beyond those listed in the Ravalli County Growth Policy (2002) and the City of Hamilton Comprehensive Master Plan (1998).



Source: Architects Design Group (2002)

Locations of reasonably foreseeable actions subject to change.

Property Line
Fence
Historic District
Proposed Action
Reasonably Foreseeable Actions

Proposed Action and Reasonably Foreseeable Actions
RML Integrated Research Facility
Hamilton, Montana
FIGURE 4-1

Education

School capacity is adequate for growth, including projections for the Integrated Research Facility, especially since school-aged population levels are decreasing.

Community Safety and Risk

The increased physical and procedural safety measures inherent in the BSL-4 laboratories and the Integrated Research Facility increase security. Increased security would actually reduce threats from terrorism and possible release of a studied agent into the community. The BSL-4 laboratory is designed to be self-contained, and there is complete redundancy in the electrical and mechanical systems. In more than 30 years of working with BSL-4 agents in the U.S., there has never been a confirmed release to a community from a laboratory (see **Appendix D**). Few incidences of infections of laboratory workers have occurred. However, backup mechanical and procedural safety systems for these laboratories identified the incidents, and actions were taken to protect the worker and the public from infection.

The mission of NIH the nature of how agents would be studied at RML, and the inability of many agents to directly transmit from human to human without an intermediate host or deliberate act (e.g. bite, intimate contact), also reduces the risk to the community. NIH, and its associated laboratories, including RML, do not and would not work with weapons-grade material. NIH is the steward of medical and behavioral research for the nation, whose mission is "science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability" (USDHHS 2001). In realizing this mission, NIH provides leadership and direction to programs designed to improve the health of people by conducting and supporting research in the causes, diagnosis, prevention, and cure of human diseases. This research requires a small quantity of nonweapons-grade materials, while reducing the threat of spread to the community and the chance of becoming a target for terrorism.

It is not known specifically what agents would be studied at the Integrated Research Facility. It is known that smallpox would not be studied. In the U.S., CDC in Atlanta is the only place where smallpox research is allowed. Because NIH's mission is to reduce illness from emerging and re-emerging diseases, NIH and RML operate in a reactionary mode, shifting research emphasis to those diseases.

All NIH laboratory facilities are designed and constructed to a BSL-2. The exact containment requirements of agents vary by protocol and are determined through risk assessment by the Institutional Biosafety Committee (IBC), the biological safety officer (BSO), and other relevant entities. New, emerging, or re-emerging pathogens would be handled conservatively, because often the scientific information necessary to conduct a reliable risk assessment has not yet been developed or discovered. Hantavirus with pulmonary syndrome (new world hantaan virus), HIV, and SARS are examples of organisms that have been safely handled by NIAID personnel in laboratories using conservative containment approaches until pertinent scientific data could be collected. Further, NIH maintains Certified Biological Safety professionals on staff to ensure that appropriate practices, procedures, equipment, and containment facilities would be used.

All diseases that would be studied at the Integrated Research Facility are naturally occurring. Spread of diseases may occur as they overcome natural mechanisms that keep them in check or through manipulation by man to make them more virulent. For many diseases, transmission from person to person is not possible without an intermediate host or a deliberate act. For example, person-to-person transmission of Ebola hemorrhagic fever and Marburg fever from person-to-person occurs through direct contact with infected blood, secretions, organs, and semen (see **Appendix B**). Hemorrhagic fevers commonly require the bite of an infected host (e.g., tick) for transmission to occur. Therefore, the nature of transmission of many diseases that would be studied at RML provides a natural mechanism restricting their spread in the community.

Numerous methods would be employed to control access to agents and for the facility to reduce the potential for release of an agent to the environment or community. These include:

- Specialized laboratory construction;
- Employee screening and training;

- Site security;
- Air and wastewater treatment;
- Backup systems; and
- Emergency response.

As described in Chapter 2 and **Appendix E**, BSL-4 laboratories are constructed and operated to reduce or eliminate potential for worker exposure and release of an agent. The laboratory design and decontamination protocols for workers and materials brought in and out of the laboratories (See **Appendices D and E**) provides advanced laboratory safety. All scientists working in the Integrated Research Facility must demonstrate superior training and working knowledge of laboratory procedures aimed at preventing infection and release of agents. Regular training would be completed to ensure that workers remain true to the policies and protocols.

Details on how waste streams (air and water) would be handled to prevent release of an agent can be found in General Building Design Components in Chapter 2. These state-of-the-art systems, proven through use at existing BSL-4 laboratories, would prevent possible release of agents from the Integrated Research Facility. System maintenance and monitoring would be completed to ensure proper operation. Biological safety procedures would be based on the concept of containment and would follow the maximum standards of facility design available (CDC 1999). The facility design for maximum-containment BSL-4laboratories has been established and tested at the CDC facilities in Atlanta, Georgia, and the United States Army Medical Research Institute of Infectious Diseases at Ft. Detrick, Maryland (CDC 1999, Wedum 1996, Crane *et al.* 1999).

Use of primary and secondary laboratory barriers (e.g., personal protective equipment, biological safety cabinets, airlocks, etc.) would be carefully designed and implemented in the NIH exposure control plan. This plan would be followed at the proposed facility. The plan describes integration of biological risk assessment, safety equipment, training, and occupational health services into coordinated standard operating procedures (see **Appendix E**) for prevention, detection, and mitigation of potential laboratory acquired infections.

Engineering controls designed into the BSL-4 facility, particularly the air-handling systems and HEPA filtration placement, would prevent escape of potentially infectious materials from the laboratory. Several backup systems aimed at preventing a release would be put into place, including automatic lock-down when power is lost, backup power generation on campus, and backup wastewater and air systems should one be offline for maintenance and disinfection. These systems would be incorporated into the design to ensure releases would not occur. Backup power on the community water system is also planned by the City of Hamilton (see Water Supply in Chapter 3).

Security measures aimed at protecting workers and the community are provided in Chapter 2. Access to the Integrated Research Facility requires the highest clearance from the Laboratory/Branch Chief in accordance with NIH and RML security protocols for access to the BSL-4 laboratory. No one would be allowed to enter the BSL-4 laboratory alone. No opportunity would exist for unauthorized or undocumented access to the BSL-4 facility.

The combination of pre-planning, engineering controls, and limitation of access to the Integrated Research Facility would reduce the risk of laboratory-acquired infections.

Agent Communicability and Treatment

Understanding communicability of infectious diseases has evolved over the last 10 years. In the past, a person exposed to BSL-4 type agents was immediately placed in isolation for 21 days (Risi 2003). Infectious disease specialists now know that it takes at least 48 hours for an exposed person to become contagious, regardless of microbe type. This provides adequate time to transport and initiate treatment to benefit the individual and isolate a potentially exposed person from the greater population.

Protocols exist for treatment of personnel injured or potentially exposed at RML. Through collaboration with local emergency response agencies, the steps to follow in the event of a potential exposure at RML would include:

- Remove the patient to a safe area outside the laboratory and prepare for transport and complete initial triage;

- Transport the patient to a local hospital if there is a life-threatening injury (in addition to potential exposure) or stabilize for transport to a regional hospital;
- Assess the patient's condition and risk to the community;
- Place the patient in isolation, if warranted; and
- Initiate treatment.

Emergency Response

Local emergency response agencies indicate they have the ability to respond quickly and adequately to any emergency that may arise at RML. The Hamilton Volunteer Fire Department is confident in their ability to respond to an emergency at RML (Wilson 2003a). The Fire Department is working with RML to ensure that it has the equipment needed to respond to any fire incident at the RML campus. Neither the Hamilton Police Department nor the Ravalli County Sheriff's Department expects the proposed construction and operation of the Integrated Research Facility to create the need for more officers and equipment (Auch 2003; Hoffman 2003). The Bitterroot Valley EMS, the local ambulance service, does not anticipate that the proposed Integrated Research Facility would present any specific problems to the EMTs, nor does the organization foresee the need for additional employees or equipment (Neff 2003). The proposed Integrated Research Facility would not create a need for additional staff at Marcus Daly Hospital, but capital improvements may be needed should a potentially infected person with a life-threatening injury be transported to Marcus Daly for stabilization prior to transport to a regional hospital such as St. Patrick Hospital in Missoula (Bartos 2003). St. Patrick Hospital meets all required standards for handling infectious disease cases (Risi 2003).

Most emergency response agencies indicated that additional training on the communicability of agents and anticipated emergency response protocols would be useful. NIH and RML, in collaboration with local emergency response agencies, have committed to provide this training.

Reasonably foreseeable actions are provided in Cumulative Effects, Section 4.2.2.

Risk Assessments

Theoretically, human error or multiple, simultaneous mechanical failures could lead to accidental release of biological materials. However, redundancy of safety equipment and procedures, operational safeguards, monitoring systems, and the overall safety record of biomedical and microbiological laboratories indicate that this is not a significant risk. Nevertheless, in order to address community safety concerns, the NIH applied both qualitative and quantitative risk assessment strategies to investigate potential community impacts of the proposed Integrated Research Facility at the RML. The qualitative assessment included a literature review regarding laboratory acquired infections; a review of all infectious disease research protocols performed by the NIAID requiring BSL-2 with BSL-3 practices; BSL-3; or BSL-4 facilities for the past two decades; review of all NIAID accidents associated with these laboratories; injuries and illnesses during the same period of time (see **Appendix D**); and review of RML medical waste incinerator operations, infectious waste handling procedures, animal containment, and procedures for biological material shipment. Additionally, a survey was conducted to determine the safety records of BSL-4 laboratories worldwide with 20 or more years of operating experience.

Laboratory-Acquired Infections. Literature review reveals that laboratory-acquired infections have occurred since bacteria were first isolated. Within four years of the isolation of diphtheria, Riesman reported the first documented laboratory-acquired infection in 1898. Since that time, laboratory-acquired infections have been tracked in the scientific literature. The most recently published review indicates approximately 5,346 occupationally acquired infections have occurred in individuals working with microorganisms since 1898 (Harding and Byers 1999). Since the publication by Harding *et al.*, six more infections acquired occupationally have been reported by the Centers for Disease Control and Prevention in the Morbidity and Mortality Weekly Report (MMWR) involving *Neisseria meningitis* (bacterial meningitis) in two laboratory workers in clinical settings; a microbiologist in a research laboratory who contracted *Burkholderia mallei* (glanders); two cases of West Nile virus contracted through either a puncture or laceration in public health laboratory situations; and one case of cutaneous anthrax in an worker in an environmental microbiology laboratory. This is a remarkably small number of occupationally acquired infections reported world-wide over a 100-year period given the vast amount of microbiological activity that has occurred in both clinical and research settings during that time. Further, no reports have been found of laboratory-attributable infection in persons who were never in a laboratory building or who were not in some way associated with the laboratory (Wedum 1996).

The NIAID has recently conducted a retrospective study of all reported injuries and illnesses in the last 20 years (1982-2003) within the Institute occurring in BSL-3 laboratories or BSL-2 laboratories utilizing BSL-3 practices and procedures (Johnson 2003, see **Appendix D**). Employees at risk of exposure worked approximately 3,189, 700 hours with a variety of microbial organisms resulting in one clinical infection and four so-called "silent infections" (meaning without symptoms) documented through antibody production or skin test conversion. There is no evidence that any microorganism was released from these laboratories; nor were there any infections in adjacent civilian communities. This record stretches to 70 years at the Rocky Mountain Laboratories (Johnson 2003, see **Appendix D**).

With regard to other BSL-4 (formerly designated P4) laboratories worldwide, the safety record is remarkable. In a 10-year period from 1959-1969, only one laboratory-acquired infection occurred in a worker in each of the two existing P4 facilities at Ft. Detrick, Maryland (Wedum 1996). Both infections were cutaneous in nature, did not require hospitalization, and posed no risk to the community. NIAID has performed a survey of BSL-4 laboratories worldwide with over 20 years of operating history to determine the number and severity of laboratory-acquired infections occurring within these facilities (Johnson 2003, see **Appendix D**). In the past 31.5 years (approximately 344,000 man-hours of work), in newer BSL-4 suit facilities at the U.S. Army Research Institute for Infectious Diseases (USAMRIID) at Ft. Detrick, Maryland, there have been no clinical or sub-clinical infections from any BSL-4 agent. There have been no environmental releases of infectious agents from these laboratories. The Centers for Disease Control and Prevention has operated P4/BSL-4 facilities for over 30 years (120,560 man-hours of work in BSL-4 laboratories). There have been no clinical or sub-clinical infections and no releases of infectious agents to the environment. The National Institute for Communicable Diseases in Johannesburg, South Africa, has operated BSL-4 laboratories for over 22 years (approximately 40,000 man-hours), where much of the work was devoted to searching for wild reservoirs of Marburg and Ebola viruses. No infections or environmental releases of infectious agents have been recorded. In summary, over 604,000 man-hours of work with exotic agents in BSL-4 laboratories have taken place without any evidence of laboratory-acquired infection or environmental release.

Based on the NIAID safety record over the past two decades; the safety record in general of P4/BSL-4 laboratories; the lack of occupationally acquired infections in employees working in these facilities during the past 30 years; and the fact that there have been no environmental releases of infectious agents from these facilities, the conclusion can be made that the risk to communities surrounding BSL-4 laboratories is negligible.

Inactivation of materials infected with agents of transmissible spongiform encephalopathies (prion diseases). High temperature incineration continues to be the disposal method of choice for medical and veterinary wastes as it has been demonstrated to be effective at inactivating all types of pathogens. Currently the only approved method for disposing of prion-contaminated animals and animal waste/bedding is incineration (WHO 1999). Due to the amount of prion research conducted at RML, an on-site incinerator is required. Modern incinerators with efficient effluent scrubbing systems, such as the RML incinerator, provide an environmentally and economically superior method for disposal of medical/pathological waste compared to transporting via diesel-powered vehicles to a landfill. Additionally, the on-site incinerator provides a critical redundant method for disinfection and disposal of medical/pathological waste generated by research conducted at RML.

Safe disposal of potentially infectious wastes is an issue of concern to all biomedical laboratories. Of particular concern are wastes potentially contaminated with the agents that cause a group of diseases referred to as transmissible spongiform encephalopathies (TSE), commonly referred to as prion diseases. These agents are resistant to most conventional methods of inactivation, including heat processing (Taylor 1998).

The incinerator at RML is a Consumat 325 Incinerator. Both state and federal authorities license it as a hospital medical infectious waste incinerator. To be certified as such, the two-stage incineration process must allow for a minimum of four hours of burn time at approximately 1800°F (983°C). This burn time is much longer than allowed in the following referenced experiments. The operational plans for this incinerator also include a variety of standard maintenance and operational testing to ensure that each run maintains that minimum temperature. (There is another incinerator at RML (Consumat 225), but this unit will not be used to incinerate infectious materials.)

Experiments conducted by the NIH indicate that high-temperature incineration can completely destroy agents of TSE. When experimental inactivation of tissues containing high concentrations of a particularly heat resistant strain of TSE (hamster adapted scrapie strain 263K) was performed under incineration-like conditions at approximately 1000°C for 15 minutes, no detectable infectivity remained in the ash (Brown *et al.* 2000, Brown *et al.* 2003). Similar experiments performed at 600°C for 15 minutes demonstrated a very low level of residual infectivity in the ash.

No information or data has been published to suggest that TSE agent infectivity may form as recombination products from cooling of non-infectious emissions. The presence of an inorganic template of agent replication from infectious material has been hypothesized to explain the extreme resistance of TSE agents in ash to thermal inactivation. This hypothesis assumed potential formation directly from infectious material, not that it formed from non-infectious incineration products (Brown 2000).

In order to evaluate this hypothesis, a series of experiments simulating combustion conditions in medical waste incinerators, including a starved-air, two-stage design similar to the Consumat 325, have recently been completed (Brown *et al.* 2003). Bioassays of cooled air emissions from combustion of tissues infected with high concentrations of scrapie strain 263K at 600°C and 1000°C revealed no evidence of infectivity, confirming that emissions to the stack do not contain detectable infectious agents released from the combustion chamber or formed as recombinants on cooling.

Decontamination of exhaust air. Air exhausted from biological safety cabinets (a piece of laboratory containment equipment in which infectious materials must be manipulated at BSL-3 and above) is passed through a high-efficiency particulate air (HEPA) filter prior to recirculation to a laboratory room or discharge through the building exhaust system. These are disposable, extended/pleated medium, dry-type filters with (1) rigid casing enclosing the full depth of the pleats; (2) minimum particulate removal of 99.97% for thermally generated monodisperse dioctylphthalate (DOP) smoke particles or equivalent with a diameter of 0.3 µm; (3) maximum pressure drop of 250 Pa (1.0 in wg) when clean and operated at rated airflow capacity; and (4) no area showing a penetration exceeding 0.01% when scan-tested with polydisperse aerosol having a light scattering median size of 0.7 µm and a geometric standard deviation of 2.4 (National Sanitation Foundation (NSF) 2002). These filters are also used to treat exhaust air prior to discharge to the outdoors. In a BSL-4 laboratory, two HEPA filters are used in series to assure the exhaust air is sufficiently treated before discharge to the outdoors. In effect, all discharge air is filtered at least twice, and in many cases three times, prior to discharge. HEPA filter installations, whether in containment equipment such as biological safety cabinets or in building mechanical systems, are tested in place at least once per year using NSF Standard 49 procedures (NSF 2002) that provide quantitative assurance that the installations do not contain defects that reduce microbiological safety. HEPA filters are known to have long functional lives; however, age does play a factor in decreasing tensile strength of the filter media (First 1996; Edwards 2002). For this reason, the RML Integrated Research Facility would use a conservative terminal date of five years of service for HEPA filters in biological safety cabinets and other applications (First MW, 1996). The likelihood of infectious microorganisms being exhausted from the Integrated Research Facility in numbers sufficient to cause harm to the public or the environment is negligible.

Escape of an Infected Animal. The likelihood of escape of an infected animal from a containment animal facility is extremely remote. Due to the specialized design and construction of BSL-3 and BSL-4 laboratories, modes of escape are minimized to the maximum extent. Containment husbandry practices further reduce the already miniscule risk. Simultaneous breakdown of multiple levels of physical and procedural controls would need to occur for a live animal to escape from the containment laboratories. Daily observations of animals are performed to further reduce the possibility that a missing animal would go unnoticed.

A BSL-4 animal room is an airtight room with positive pressure gasket doors providing an absolute seal when the doors are closed. Access to these areas is through airlocks with interlocking positive pressure doors and a chemical shower, thus adding even more physical barriers. In the event that a small animal escapes from a cage or is dropped during a manipulation, there is no avenue of escape available from the room. In these rodent rooms, baited live traps are used as standard practice as an extra precaution so that, in the event an animal escapes into the room, the valuable research animal can be recovered alive. All cages and bedding are decontaminated in an autoclave prior to removal from the containment facility. Should an animal burrow in bedding and not be transferred to a fresh cage prior to removal from the animal room, it would not survive the decontamination process.

The BSL-3 animal rooms are also accessed via air lock through interlocking doors. These doors are fitted with "sweeps" and open inward to preclude animal escapes. Small rodents housed in BSL-3 animal rooms are maintained in micro-isolator cages in ventilated cage racks that serve as a primary barrier preventing escape of the animal. As in the BSL-4 animal room, baited live traps are employed as a secondary measure to prevent escapes and to preserve valuable laboratory animals. Daily animal observation is a matter of good husbandry practice and is required for accreditation of the RML animal care and use program. BSL-3 laboratories are, by design, removed from general access corridors, thus even further reducing the likelihood of an animal reaching an exterior door. Animal bedding and cages must also be decontaminated prior to removal from the containment facility. An animal hidden in bedding would not survive the decontamination process.

The potential risk to the public from an infected animal is so minimal that it can be described as zero.

Biological Material Shipment. The packaging, labeling, and transport of etiologic agents (see **Appendix C**) are regulated 42 CFR 72 (Interstate Shipment of Etiologic Agents); 49 (CFR 172 and 173 U.S. Dept. of Transportation regulations concerning shipment of hazardous materials); 9 CFR 122 (U.S. Dept. of Agriculture [USDA]-Restricted Animal Pathogens, and International Air Transport Association (IATA) rules. In addition, special rules apply for the transport of materials regulated by the U.S. Food and Drug Administration (21 CFR 312.120, Drugs for Investigational Use in Laboratory Research Animals or in Vitro Tests). Recent legislation (the USA PATRIOT Act, and the Public Health Preparedness and Bioterrorism Response Act of 2001) have further strengthened the regulations controlling transport of certain etiologic agents, referred to as select agents, to include controls over possession and use. The RML is registered with the Centers for Disease Control and Prevention and the U.S. Department of Agriculture for possession, use, and transport of these agents. A responsible official is designated at RML and approved by the regulating agencies to oversee the shipping, receipt, and usage. Packaging requirements are strictly implemented in accordance with IATA regulations.

Worldwide, there have been no cases of illness attributable to the release of infectious materials during transport, although incidents of damage to outer packaging of properly packaged materials have been reported (World Health Organization, 2002; U.S. Department of Transportation, 2001).

The risk to the community surrounding RML and specifically the Integrated Research Facility from transport of infectious agents or other biologically derived material is negligible.

Risk Assessment Scenarios. The NIH has performed a quantitative risk assessment of release of an infectious agent to the surrounding Hamilton community from the proposed BSL-4 Integrated Research Facility at RML. The quantitative risk assessment was driven by reasonably foreseeable, credible threat scenarios. It addresses spills and work disruption; safety system operation and potential failures; and fire. The modeling tool used to perform these analyses was the Maximum Possible Risk (MPR) model developed by the NIH. Anthrax, in spore form, was chosen as the worst-case scenario agent based on public health impact and dissemination potential (Rotz *et. al.* 2002). Anthrax itself is not a BSL-4 agent, but it does pose a higher potential hazard to workers in the immediate vicinity and the surrounding community upon accidental release than the BSL-4 viral agents. This is due to its innate resistance to environmental factors (e.g. sunlight, lack of humidity, etc.) that normally tend to inactivate viruses and ease of airborne dissemination. Preliminary range finding studies were performed simulating accidental laboratory releases of 10 billion anthrax spores to determine the number of respirable particles generated that become airborne. Approximately 400,000 respirable particles were produced in the range finding studies of simulated laboratory accidents and were available to become and remain airborne. These data were introduced into the MPR model to generate a very cautious, quantitative estimate of the risk for each of the scenarios. The estimate of risk is based on potential dispersion of accidentally released spores approximately 100 meters from the BSL-4 ventilation exhaust stack, which represents the nearest residence in the surrounding Hamilton community. Risk scenarios evaluated included those with countermeasures in place and functioning properly, as well as system failure scenarios. Assumptions made for input into the MPR model are as follows:

1. A release point is assumed. For laboratory spills, it is the top of the building exhaust stack. The exhaust velocity is not used in calculation of the dispersion pattern in the MPR, therefore decreasing potential area in which the spores can disperse within the model. A dispersion pattern is also assumed. It is a horizontal cone starting at the release point and extending 100 meters.
2. All the spores are assumed to go in one direction, as if the worst possible wind pattern is at play. In any actual incident, turbulence would, in fact, disperse the spores more broadly so that the concentration would fall to harmless levels well before any spores left the RML grounds.
3. Independent of the dispersion pattern, a pathogenic total cumulative level of spores, e.g. 500, is assumed and is an input to the model. Documented evidence suggests that the pathogenic level is greater than 500 spores over an eight-hour period (Brachman 1966). In addition, a respiration rate of 12 liters per minute and total exposure time of 20 minutes is assumed. From these inputs, a pathogenic concentration, in spores per liter, can be computed. For example, a concentration of 2.08 spores per liter, breathed for 20 minutes at the rate of 12 liters per minute would accumulate to 500 spores. This corresponds to an airborne concentration of 2083 spores per cubic meter of air.
4. The pathogenic concentration is then compared to the concentration produced by the dispersion model at and outside the 100-meter radius from the lab in which the actual dispersed concentration could present a temporary hazard.

The MPR analysis (based on the exposure time and respiration rate) for the Integrated Research Facility BSL-4 laboratory uses a cautious approach of "maximum possible risk." Specifically, numerous simplifying assumptions are used that we know for certain are more unfavorable than any credible assumptions. For example, we assume that spores, once released, populate a simple cone or spherical pattern; in fact, they would certainly disperse in a far more complex pattern that would inevitably reduce them to nonpathogenic concentrations more rapidly than the MPR analysis will allow. This approach makes the calculations easy to understand, avoids controversies over the details of turbulent dispersion, and gives extra confidence since the actual risks are certain to be less than the risks presented in the analysis. Scenarios for the

BSL-4 facility subjected to MRP analysis are specified below:

1. A researcher is working within a Class 2 BSC that is ducted and located within a BSL-4 laboratory. He is handling a 15 cubic centimeter (cc) conical tube containing a powder-like preparation of purified anthrax containing 10 billion spores. The cap fits loosely. The researcher accidentally drops the tube on the bare, stainless steel surface of the properly operating BSC. The cap comes off of the tube upon impact and a visible cloud of spores is released within the cabinet.

The cabinet is exhausted through a dedicated heating, ventilating, and air conditioning (HVAC) system for the BSL-4 laboratory that contains two properly seated and gasketed high-efficiency particulate air (HEPA) filters, in series, in the exhaust system. The air change rate within the room is 12 air changes per hour (ACH). The typical laboratory dimensions have been provided. The laboratory has a 10-foot ceiling. The exhaust stack height is five meters. The total exhaust air volume from the BSL-4 laboratory is 17,018 liters per second. The exhaust velocity is 20 meters per second.

What is the potential for release of anthrax spores to the external outdoor environment?

The calculated potential release to the environment described in this scenario would be 0.000011 spores. Since release of a partial spore is not feasible, this number is practically rounded to zero.

What is the probability of public health harm?

The safety features designed into the laboratory would prevent even one spore being breathed by an individual in the nearest residence as a consequence of an accidental laboratory spill.

2. A researcher is working within a Class 2 Biological Safety, Type A that is not ducted and located within a BSL- 4 laboratory. He is handling a 15 cc conical tube containing a powder-like preparation of purified anthrax containing 10 billion spores. The cap fits loosely. The researcher accidentally drops the tube on the bare, stainless steel surface of the properly operating BSC. The cap comes off of the tube upon impact and a visible cloud of spores is released within the cabinet.

The cabinet recirculates HEPA-filtered air to the laboratory room; the air is then exhausted through a dedicated HVAC system for the BSL-4 laboratory that contains two properly seated and gasketed high efficiency particulate air (HEPA) filters. The air change rate within the room is 12 air changes per hour (ACH). The typical laboratory dimensions have been provided. The laboratory has a 10 ft. ceiling. The exhaust stack height is 5 meters. The total exhaust air volume from the BSL-4 laboratory is 17,018 liters per second. The exhaust velocity is 20 meters per second (m/s).

What is the potential for release of anthrax spores to the external outdoor environment?

The calculated potential release described in this scenario would be 0.000011 spores. Since release of a partial spore is not feasible, this number is practically rounded to zero.

What is the probability of public health harm?

The safety features designed into the laboratory will prevent even one spore being breathed by an individual in the nearest residence as a consequence of an accidental laboratory spill.

3. A researcher is working within a Class 2 BSC that is ducted and located within a BSL-4 laboratory. He is handling a 15-cc conical tube containing a powder-like preparation of purified anthrax containing 10 billion spores. The cap fits loosely. The researcher accidentally drops the tube on the bare, stainless steel surface of the properly operating BSC. The cap comes off of the tube upon impact and a visible cloud of spores is released within the cabinet.

The cabinet is exhausted through a dedicated HVAC system for the BSL-4 laboratory; however, both HEPA filters were accidentally left out of the filter housings. The air change rate within the room is 12 air changes per hour (ACH). The typical laboratory dimensions have been provided. The laboratory has a 10-foot ceiling. The exhaust stack height is five meters. The total exhaust air volume is 17,018 liters per second. The exhaust velocity is 20 meters per second.

What is the potential for release of anthrax spores to the external, outdoor environment?

The calculated potential release to the environment described in this scenario would be 1 spore per 8,727 cubic meters of air.

What is the probability of public health harm?

Due to the pressure monitoring devices and alarms included in the building design and the installation, maintenance, testing, and certification program for all HEPA filter installations, the exhaust system would shut down when the HEPA filters did not operate. Therefore, there should not be any biological material (spores) released into the environment. Even if these systems failed and the entire number of aerosolized spores was exhausted from the laboratory, the concentration under the maximum possible risk model would still be only one spore per 8,727 cubic meters of air. As a point of reference, the average breathing rate for a human is 12 liters per minute (1000 liters = one cubic meter), meaning that a human breathes approximately 6,307 cubic meters of air in an entire year.

The risk of public harm is so minute that it may be considered zero.

4. A researcher is working within a Class 2 BSC that is ducted and located within a Biosafety Level 4 laboratory. He is handling a 15-cc conical tube containing a powder-like preparation of purified anthrax containing 10 billion spores. The cap fits loosely. The researcher accidentally drops the tube on the floor of the BSL-4 laboratory. The cap comes off of the tube upon impact and a visible cloud of spores is released within the laboratory room.

The cabinet is exhausted through a dedicated HVAC system for the laboratory; however, both HEPA filters were accidentally left out of the filter housings. The air change rate within the room is 12 air changes per hour (ACH). The typical laboratory dimensions have been provided. The laboratory has a 10-foot ceiling. The exhaust stack height is five meters. The total exhaust air volume is 17,018 liters per second. The exhaust velocity is 20 meters per second.

What is the potential for release of anthrax spores to the external, outdoor environment?

Taking the maximum possible risk approach, assuming that there is no loss of aerosolized spores through sedimentation or impaction on the duct work, approximately 400,000 respirable spores could potentially be released from the BSL-4 laboratory into the dispersal zone resulting in a concentration of one spore per three cubic meters of air.

What is the probability of public health harm?

Using an average breathing rate for a human of 12 liters per minute (1,000 liters equals one cubic meter), an individual would have to breathe one spore per three cubic meters of air concentration for over four hours before even one spore would be inhaled. Clearly, the conservative pathogenic concentration used in this assessment of 500 spores over eight hours would never be achieved. Furthermore, due to the pressure monitoring devices and alarms included in the building design and the installation, maintenance, testing, and certification program for all HEPA filter installations, the likelihood of this modeled release occurring is further reduced. The risk of public harm is so minute that it may be considered zero.

5. A researcher is working within a Class 2 BSC that is ducted and located within a BSL-4 laboratory. He is handling a 15-cc conical tube containing a powder-like preparation of purified anthrax containing 10 billion spores. The cap fits loosely. The researcher accidentally drops the tube on the floor of the BSL-4 laboratory. The cap comes off of the tube upon impact and a visible cloud of spores is released within the laboratory room. At this exact moment, the building is struck by a major electrical outage and the HVAC system fails.

What is the potential for release of anthrax spores to the external, outdoor environment?

None. The Biosafety Level 4 laboratory HVAC system is designed with numerous safety controls in place. In the event that either the exhaust or supply systems shut down, electronic interlocks on these systems assure that the laboratory is not pressurized. In the event of a total electrical outage, when neither exhaust nor supply air is provided to the laboratory, the pressure differential will drop to zero and the room becomes static with regard to airflow. Additionally, positive pressure bubble dampers, installed for decontamination purposes on BSL-4 laboratories, close and isolate the air in the laboratory. The anthrax spores would not be released into the environment because there would be no pressure in the laboratory to push the air through the series of two HEPA filters. The HEPA filters would continue to provide a physical barrier against release of spores even in the shut-down mode.

What is the probability of public health harm?

None. No spores would be released to the environment.

6. A researcher handling anthrax cultures is hurrying to finish work on a Friday afternoon. Freshly inoculated *B. anthracis* cultures on 5% sheep blood agar plates are placed in the incubator. She places a stock of anthrax spores (10 billion spores in 10 mL of phosphate buffered saline in a 50-cc polypropylene tube) in the secure laboratory refrigerator. In her haste, she does not notice that a heated water bath has been left on and has no water left in it. The water bath does not have an automatic "over temp" switch-off. Sometime late Saturday evening, the water bath overheats and a small fire ignites. Some small cardboard boxes are stored on a shelf above the water bath. The room is sprinklered and alarmed. The Hamilton Fire Department responds to the alarm within four minutes.

What is the potential for release of anthrax spores to the external, outdoor environment?

None. The spores are secured in a locked refrigerator consistent with Department of Health and Human Services Select Agent storage guidance for compliance with the USA PATRIOT Act. The laboratory sprinkler system will discharge as soon as the cardboard combustibles begin to burn, dousing the fire. In the event that the sprinkler fails to completely douse the fire, the Hamilton Fire Department also responds within approximately four minutes. Additionally, one-hour fire rated walls prevent expansion of the fire beyond this laboratory module.

What is the probability of public health harm?

None.

Transportation

Potential impacts from traffic associated with the Proposed Action were evaluated in a residential portion of Hamilton, Montana, where most traffic entering and leaving the RML campus would occur. This area is defined by U.S. Highway 93 North on the east, Ravalli Street on the north, 8th Street on the west, and the southern property line of the RML campus on the south. The amount of existing resident and RML traffic through this area was compared to the estimated additional traffic that would be associated with the Integrated Research Facility.

Based on a July 1995 aerial photograph of the area (NRIS 2002) and property line coordinates available from the Montana Department of Administration (1999), approximately 204 residences are located within the residential area described above. Presently, 250 RML employees (see Section 3.3.2) travel through the area. The number of permanent federal employees would ultimately increase to 350 (see Section 4.2.1). Most of the traffic to and from RML and within the adjacent residential area occurs during the morning and evening commute periods. Peak hour travel during the evening commute is 0.79 trips per household and 0.45 trips per employee (Morrison Maierle 2002).

RML traffic is presently 41 percent of the area's peak hour traffic and would ultimately become 48 percent of the area's traffic with completion of the Integrated Research Facility (see **Table 4-1**). The difference between current and predicted RML employees traffic is 45 trips. When divided by the current number of trips (274), this is a 16 percent increase due to operation of the Integrated Research Facility.

Discussions with Hamilton's city administrator reveal that delivery services to RML would not noticeably change after expansion of the facility. USPS, UPS, FedEx, freight services etc., would continue to use current routes to enter and leave the campus. Administrative support traffic (i.e., errands, deliveries) would be similar to the present condition. Local residents would experience little additional traffic during the day.

The primary approach to RML is from Ravalli Street and South 4th Street (a local collector). South 7th Street is also shown as a local collector in the 2002 Hamilton Transportation Plan, but it would require upgrades (See Section 3.1.1) to function effectively as a local collector.

Table 4-1. Peak Hour Traffic (Current and Expected)

	2002	2006
Residential		
Residences	204	204
Trips	161	171*
RML		
Employees	250	350
Trips	113	158
Total Trips	**274**	**329**

* Reflects a 1.5% increase in traffic per year.

Periods of increased security at RML may cause increased on-street parking adjacent to RML to avoid entry delays.

Transportation of agents would continue to meet requirements outlined in **Appendix C**.

4.2.1.2 No Action

Population and Demographic Trends

Population growth would continue at the current pace under the No Action Alternative (**Table 4-2**). Between 8,000 and 18,000 persons are projected to relocate to Ravalli County by 2010. People are choosing to move to Ravalli County primarily for quality of life issues, not job opportunities.

Table 4-2. Population Projections

Area	2000 Pop.	2010 Pop. (2%/year)	2010 Pop. (4%/year)
Ravalli County*	36,070	7,930 new 44,000 total	17,930 new 54,000 total
City of Hamilton	3,705	695 new 4,400 total	1,795 new 5,500 total

*Based on information in the Ravalli County Economic Needs Assessment (Swanson 2002).

Housing

Under the No Action alternative, annoyances attributed to the proposed Integrated Research Facility construction phase would not occur, and neighbors would not be as concerned about the biological agents used at the Integrated Research Facility.

Housing starts would continue at the same pace as under the Proposed Action, although houses may remain on the market longer with fewer qualified buyers. Housing prices or property values are expected to remain at current levels and to increase or decrease following the real estate market in Hamilton.

Community Safety

Current levels of community services, emergency response training and programs, and infrastructure would not change under the No Action Alternative. Infectious diseases would still be studied in the BSL-2 and BSL-3 laboratories at RML. Reasonably foreseeable actions such as completion of community emergency response protocols are defined in Cumulative Effects, below.

Transportation

The current use of streets by neighborhood residents and RML employees would continue.

4.2.2 Cumulative Effects

Population and Demographic Trends

Population change results from both migration (the number of people moving to an area and away from an area) and natural change (the number of area births and deaths). Natural change alone would lead to a decreasing population in Ravalli County because of a decreasing birth rate and a stable death rate. Assuming that recent population growth trends based on net in-migration to the valley continue during the decade, the Ravalli County Economic Needs Assessment (Swanson 2002) predicts that growth will range from two to four percent per year because "the factor most affecting future growth is what will happen to perceptions of the valley's attractiveness as this fast growth continues and increasingly takes its toll on the very thing enticing more people to move to the valley – the area's scenic qualities and rural character." The population may grow to between

44,000 and 54,000 people by 2010 (**Table 4-2**), leading to lower-end increases of at least 8,000 people, or approximately 800 people per year, and up to 18,000 people, or 1,700 people per year on the higher end. These growth projections do not include additional employment at RML.

Housing

According to the Ravalli County Growth Policy (2002), future trends are difficult to predict, although continued, scattered residential development is expected. Between 3,200 and 6,800 new homes would be needed by 2010 to accommodate projected growth. According to the Ravalli County Economic Development Authority, about 500 homes have been constructed each year since 2000 at prices ranging from $150,000 to $170,000. Commercial and industrial development is expected near existing service centers and along U.S. Hwy 93. Missoula would continue to be the regional economic center.

Community Safety

Under the Proposed Action or No Action alternatives, reasonably foreseeable actions would be completed to improve community safety, including: construction of a new perimeter fence; relocating the main and receiving gates; construction of a new security guard station; installation of a card reader system; installation of security cameras on campus; construction of a new receiving building; and construction of a landscaped crash barrier at 4th and Grove Streets in Hamilton. Additional security guards and NIH police officers would be hired to provide added security and safety. Procedures and protocols would also be established with local emergency response agencies to address responsibilities of each agency in the event of an emergency at RML. Work with infectious agents at the BSL-2 and BSL-3 levels would continue in existing laboratories.

Transportation

Residential traffic is expected to increase at a rate of 1.5 percent per year (Morrison Maierle 2002). Experienced and expected peak hour traffic for 2002 and 2006 is shown in **Table 4-1**. The predicted increase in traffic from residents is four percent (10 trips). When added to the 16 percent increase from the Integrated Research Facility, the result is an overall 20 percent increase.

Reasonably foreseeable actions (described on page 4-1), would result in changes in traffic patterns after construction for employees of RML, as well as changes in the parking situation. Under either alternative, combined with reasonably foreseeable actions, neighborhood parking and traffic would be expected to improve. More off-street parking would be provided for cars at the entrance gate. Additional on-campus parking would be provided for visitors and employees, alleviating parking concerns for residents living near RML. Deliveries to RML would also occur through a gate along the northern boundary of the property near 5th and 6th streets, reducing congestion problems associated with the existing gate at 4th and Grove streets.

4.3 ECONOMIC RESOURCES

4.3.1 Direct and Indirect Effects

4.3.1.1 Proposed Action

Income

According to the Ravalli County Economic Needs Assessment (Swanson 2002), RML is the fourth most important asset of current and potential key economic assets of the county because it "provides area employment for highly educated and well-trained workers and brings large infusions of outside money to the area that finance the laboratory's work." The mere presence of such a laboratory in an expanding field of bioscience research creates an environment for certain types of business development that may be associated with the laboratory's work. The scientific sophistication of this work requires that such businesses have high quality and highly trained workers. This creates the opportunity for expansion of higher paying, higher quality jobs.

The Proposed Action would have direct economic impacts on both the City of Hamilton and Ravalli County throughout construction and operation. Construction workers may temporarily affect the rental market, which is already limited in Hamilton. Sufficient numbers of qualified construction workers may be hard to find in Ravalli County, and the majority of workers may commute from Missoula County for the duration of the Project.

Local retail trade would increase during the construction period. Average construction wages in Ravalli County were $23,653 in 2000. Total annual construction wages are estimated to be $4.7 million. At the current estimated economic multiplier for wages paid from "outside" the community (Nicholson 2002), the maximum expected increase in economic activity would be $18.9 million over the two-year construction period.

When the facility is fully operational, up to 100 new employees would be hired. Because of the specialized nature of the work, the work force would probably be recruited predominately at the national level (65 percent) and from colleges and universities in Montana. The total wages to be paid per year is estimated by RML at $6.6 million. Added to the current $10.4 million annual payroll, RML would contribute $17 million in wages annually. At the current estimated economic multiplier for wages paid from outside the community (Nicholson 2002), RML would contribute $34 million annually to the local economy. Government job growth is particularly valuable to the community because of the relatively high wages that add to the economic base (Nicholson 2002). RML and the proposed Integrated Research Facility meet community economic development goals in the Ravalli County Economic Needs Assessment (Swanson 2002), Ravalli County Growth Policy (2002), and the City of Hamilton Comprehensive Master Plan (1998).

Government and Public Finance

Public revenues would increase with increased income tax on construction and operation payrolls. Public revenues would also increase from the incomes of spouses and older children of RML employees, increased number of vehicles being licensed, and property tax revenues based on new homes and increased property assessments. Property taxes would increase as the needs of the county, cities, and special districts increase with new populations. Revenue or cost increases attributed to the Project would range from one to three percent of the total increased revenue and costs from the projected 8,000 to 18,000 new residents by 2010 (Swanson 2002).

4.3.1.2 No Action

Income

The No Action Alternative would not have direct economic impacts. There would be a minor increase in security staff at RML, but an opportunity to stabilize the local economy with government jobs would be lost, slowing the realization of local economic development goals.

Government and Public Finance

There would be no direct effect from No Action on government and public finance.

4.3.2 Cumulative Effects

4.3.2.1 Proposed Action

The Proposed Action would add new residents to a rapidly growing area, possibly adding stress to community service providers and infrastructure. The potential negative cumulative impacts of Corixa's expansion would include increased demands for housing, schools, and infrastructure. Based on the analyses of socioeconomic impacts for the Proposed Action, there would be adequate housing, school resources, and city infrastructure to accommodate the cumulative impacts of Corixa's and RML's expansions. Positive cumulative impacts from Corixa's expansion would be creation of new high-paying jobs and economic stability for Hamilton and Ravalli County.

4.3.2.2 No Action

Cumulative effects would occur from Corixa's expansion, which would have the same cumulative effects as the Proposed Action.

4.4 NOISE

4.4.1 Direct and Indirect Effects

4.4.1.1 Proposed Action

Construction Noise

During construction of the Integrated Research Facility at RML, short-term noise sources would include operation of heavy mobile equipment (e.g., bulldozers, backhoes, cranes, heavy trucks, pumps, generators, compressors, loaders, and compactors), use of power tools (e.g., jackhammers), and use of hand tools (e.g., hammers and drills). Equipment operation would vary considerably during the project and different days. During construction, heavy mobile equipment does not normally run continuously.

Each individual piece of construction equipment can typically generate noise levels up to 90 dBA at a distance of 50 feet from the equipment (USDOT 1995). However, equipment noise can vary considerably depending on age, condition, manufacturer, and use. Since noise is intermittent and the source can vary from day to day, it is difficult to determine the length of time that noise from a particular piece of equipment would persist during normal construction activities. The following construction noise level predictions are based on a conservative assumption that there would be five pieces of large mobile construction equipment operating simultaneously. Calculations indicate that the typical construction noise generated may equal the following approximate noise levels:

- 75 to 90 dBA along the north property line;
- 50 to 80 dBA along the south property line;
- 50 to 80 dBA along the east property line; and
- 65 to 85 dBA along the west property line.

The RML Campus Noise Level Criteria exempts construction noise activities, provided that the construction occurs between 7:00 am and 5:00 pm (Big Sky Acoustics 2003). Construction noise levels would be audible at the receptors located in the neighborhood adjacent to the RML campus. Noise may be considered intermittently adverse during various construction phases. Construction noise normally occurs during the day, and residents are generally less sensitive to noise during the day than at night. Construction noise mitigation measures are described in Chapter 2.

Integrated Research Facility

Noise sources associated with new equipment for the Integrated Research Facility include exhaust fans, air-handling units, cooling towers, and chiller operating simultaneously (for direct effects). Measures to reduce noise in the new operation are included in the design and described in Chapter 2.

Noise levels (**Table 4-3**) from the Integrated Research Facility due to simultaneous operation of the exhaust fans, air-handling units, cooling towers, and air-cooled chiller without the generator (typical daytime operations) would be designed to be less than 55 dBA on the property lines during the daytime. As indicated in **Table 4-3**, noise levels from the RML campus would generally be reduced from current levels. Testing of the emergency generator (which would only occur during the daytime) is expected to raise the noise level slightly, but daytime noise limits would not be exceeded at the property lines. At night, noise levels would not exceed 50 dBA. The Proposed Action would meet RML's new noise guidelines.

Table 4-3.
Estimated Cumulative Noise Levels

Location*	Current	Noise Level (dBA)
1	48	30-35
2	52	30-35
3	52	35-40
4	51	40-45
5	50	45-50
6	44	45-50
7	41	45-50
8	44	50-55
9	43	40-50
10	50	40-45
11	46	35-40
12	47	35-40
13	49	35-40

* See Figure 3-1.

4.4.1.2 No Action

Table 4-3 indicates the anticipated noise levels under the No Action Alternative for locations 1, 2, 3, 4, 9, 10, 11, 12, and 13 (**Figure 3-1**). Locations 5 though 8 would be lower, approximately 35 dBA, as noise in those locations would not be affected by the emergency generator. Noise mitigation devices have been ordered, but not all have been installed. Under the No Action Alternative, in all locations, noise would be similar or slightly reduced from current levels.

4.4.2 Cumulative Effects

Under both the Proposed Action and No Action alternatives, reasonably foreseeable changes in the entrance gate and employee parking area could result in a reduction in noise levels on the east side from traffic, while the north side may experience a slight increase. Additional traffic noise would be confined to periods when employees are arriving and departing. These changes would not exceed RML's draft noise guidelines.

Reasonably foreseeable noise reduction features would result in a slight reduction in noise overall as shown in **Table 4-3**. In some instances, noise would be reduced more than 10 dBA. **Table 4-4** describes how changes in noise levels are perceived. Noise is predicted to be approximately 50 dBA at the south property line and 51 dBA on the west side (2400 feet inside the property line) during daytime hours, meeting RML's draft guideline. Since predicted noise levels from the Proposed Action would be less than the current noise, cumulative effects for the Proposed Action and No Action are the same.

Table 4-4.
Perception of Change in Loudness

Change in Sound Level (dBA)	Apparent Change in Loudness to a Person
±1	Imperceptible
±3	Barely audible
±6	Clearly audible
±10	Half as loud or twice as loud as the original noise (significant change)
±20	One quarter as loud or four times as loud as the original (very significant change)

4.5 VISUAL QUALITY

4.5.1 Direct and Indirect Effects

4.5.1.1 Proposed Action

The extent to which the Proposed Action would affect visual quality depends upon the amount of visual contrast created between the proposed facility and the existing condition. The main content of the Proposed Action is construction of the Integrated Research Facility building. In addition to construction of the laboratory facility, other components of the Proposed Action include an addition to the boiler plant and relocation of the chiller and associated fuel tank. These elements would be visible changes to the existing RML campus from Viewpoint 1 (**Figure 4-2**). Ventilation stacks on the Integrated Research Facility would not be visible from Viewpoint 1.

The primary visual impact of the Proposed Action would be addition of a large building introduced into an area of many smaller buildings (**Figure 4-2**). Use of red brick color and texture would blend with existing material throughout the campus. The boiler plant addition would be directly adjacent to the east side of Building 26. The addition would be smaller, but the additional stack would be the same height as the existing stack. The existing and proposed stacks would be about 40 feet apart and 37 feet high. Both stacks would offer linear contrast to surrounding structures.

Proposed landscaping would have an impact on visual quality. This area of the RML campus would be modified from existing vegetation (weeds) to grass and trees placed around the building and its associated paved parking area (reasonably foreseeable action). Open storage areas would be eliminated or relocated away from view. All construction trailers would be removed from RML.

4.5.1.2 No Action

There would be no change from the existing condition described in Chapter 3. Some of the construction trailers would be removed from RML.

4.5.2 Cumulative Effects

Reasonably foreseeable actions would have a visual impact on the RML campus. The addition of a nine- foot fence would interrupt the view of much of the ground level activity within the campus. Street side landscaping, including a sidewalk, would add pleasant views to the campus exterior. Other reasonably foreseeable actions include addition of buildings for visitors, receiving, and storage. Future construction of the receiving and storage building would partially or completely block the view of the Integrated Research Facility from Viewpoint 1.

4.6 HISTORICAL RESOURCES

The analysis of visual impacts on the Historic District requires an assessment based on the Criteria of Effect and Adverse Effect (36CFR 800.9). The Criteria of Effect are listed in Section 800.9(a) and state, in part, that "an undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register."

The Criteria of Adverse Effect, listed in Section 800.9(b), results in one of three possible outcomes: no effects, no adverse effects, and adverse effects. No adverse effect occurs when there could be an effect, but it would not harm characteristics that qualify the property for the National Register. Adverse effect occurs when the integrity of those characteristics that qualify the property for the National Register could be diminished.

Impacts are measured by the visual character of the historic district, defined by pattern elements and pattern characters. The pattern elements are form, line, color, and texture. The pattern characters are dominance of development, scale of development, diversity of development, and continuity of development pattern (Montana State Historic Preservation Office, 1994). A score of:

- 0 indicates the element or character is absent;
- 1 indicates the element or character is present;
- 2 indicates the element or character has a moderate prominence;
- 3 indicates the element or character has a high prominence within the view.

4.6.1 Direct and Indirect Effects

4.6.1.1 Proposed Action

The Integrated Research Facility, Building 28, would be a three-story Modern Architecture style structure located north of Building 25, set back from the Historic District. The north elevation would be comprised of a glass curtain wall with projected horizontal and vertical mullions. The other three elevations would share characteristics, including common bond cement blocks on the main story, metal doors, metal clad single-pane fixed windows, and corrugated metal siding on the remaining stories with a pre-finished metal roof. The boiler plant expansion would be an addition to Building 26. The addition would be two stories that would extend across half of the east elevation of Building 26 and a stack extending upward the same distance as the current one (37 feet) on the existing boiler plant. The expansion would have common bond concrete masonry on the main floor with metal siding above. Metal clad fixed windows would be located on the south elevation and the roof would be pre-finished metal.

The RML Historic District is only partially visible from the site of the proposed Integrated Research Facility (**Figure 4-3, Figure 4-4,** and **Figure 4-5**).

Several existing structures, including Buildings 26, 20, 13, and 16, block the view of the historic district from the proposed site. Only portions of Buildings 7 and 6 in the historic district are visible from the site of the Integrated Research Facility. The boiler plant expansion would be located on the east elevation of Building 26. Building 13 blocks the view of the Historic District from the proposed site of the Integrated Research Facility; however, the stack for the new boiler would be visible.

The visual character pattern elements can be characterized by scores of 1 for form, 1 for line, 1 for color, and 1 for texture. A score of 1 reflects that the pattern elements are present in the view shed.

The combined score of pattern elements is 0.25. The pattern characters of dominance, scale, diversity, and continuity have the score of 0.25.

Applying the Criteria of Effect results in a finding of "no adverse effect" on the Historical District. The no adverse effect rating recognizes there could be an effect on the Historic District, but that the effect would not be harmful to the qualities that are inherent in the RML Historic District.

4.6.1.2 No Action

Under this alternative, there would be no change in the visual impact and therefore there would be a finding of no effect.

4.6.2 Cumulative Effects

Reasonably foreseeable actions could have an effect on the historical resources of RML.

Graphics/projects/rml/simulation

Source: CUH2A Smith Carter (2003)

Visual Simulation of Proposed IRF
RML Integrated Research Facility FEIS
Hamilton, Montana
FIGURE 4-2

Figure 4-3. Overview, facing northeast toward proposed location

Figure 4-4. Overview proposed location, facing east toward historic district

Figure 4-5. Overview from physical plant, Building 7, facing west toward proposed construction site.

fence and the road barrier at the corner of 4th and Grove streets would occur within the historic district. The new visitor center and guard station would be visible from the Historic District. At this time, the State Historic Preservation Office (SHPO) has been contacted by RML concerning the reasonably foreseeable actions to allow for review of potential historical resource effects. Since final design of the reasonably foreseeable action has not been completed, continued coordination with SHPO would be completed by RML to ensure issues are addressed, and would result in no adverse effect on the historic district.

4.7 AIR QUALITY

4.7.1 Direct and Indirect Effects

4.7.1.1 Proposed Action

Gaseous and particulate air contaminant emissions are generated during normal laboratory operations at RML. The Proposed Action would increase the overall emissions at RML. Buildings would require steam for heating, autoclaving, and other needs.

Electrical power and natural gas for the Integrated Research Facility and support buildings would be provided by the local utility. Backup (emergency) power for the new laboratory would be provided by a new diesel generator. Incinerator use is estimated to increase from approximately two to three days a week to three to four days a week.

Emissions

Emission points associated with the Proposed Action at RML would not be any closer to population centers or critical air quality receptors since the new laboratory building and boiler would be within the perimeter of RML campus and existing incinerators would be used.

The State of Montana recognizes the use of incineration as a legitimate means of handling infectious or pathological waste. MCA 75-10-1005(4)(a) states, "Treatment and disposal of infectious waste must be accomplished through the following methods: (i) incineration with complete combustion...(ii) steam sterilization...or (iii) sterilization of standard chemical techniques..."

Construction activities associated with the Proposed Action would generate short-term air impacts. These impacts would result from fugitive dust and gaseous emissions associated with construction equipment. Fugitive dust would be controlled through dust control measures. Gaseous emissions would be controlled through management of construction work hours. Overall, fugitive dust emission resulting from current exposed ground areas would decrease due to site improvements such as vegetation/landscaping and asphalt parking areas.

Air quality impacts resulting from additional natural gas usage at RML are anticipated to be minor (MDEQ 2003). Impacts on air quality would not result from emissions due to increased use of natural gas since sufficient capacity is available from the utility. Additional exploration for natural gas would not be needed to supply the Integrated Research Facility. Additionally, no air quality impacts would result from increased electrical demand since electricity is supplied by Kerr Dam, near Polson, Montana, which has surplus power on the grid.

Table 4-5 contains information on potential emissions from RML, including those associated with the Proposed Action. Values are estimated maximums from the facility and are based on 8,760 operating hours per year (24 hours per day and 365 days per year). For those components that have conditions limited by an operating permit (e.g., operational hours less than 8,760), those limits were used in the potential emission calculation shown in the table.

Air Quality Permit

The air quality permit specifies limits for incinerator charging rate, natural gas usage (for boilers and incinerators), and emergency generator run hours. The permit also specifies reporting requirements to document status of compliance with permit conditions. Additional activities that ensure facility compliance include emission testing and inspections by MDEQ. If the permit conditions are not met (e.g., emission limits exceeded), MDEQ may issue a notice of violation.

The air quality permit technical analysis conducted by MDEQ for permit 2991-04 includes the proposed boiler, emergency power generators, and increased incinerator. Based on review of the application and state and federal rules and regulations, MDEQ has determined that the proposed Project would comply with all applicable ambient standards and meet the provisions of ARM Title 17. MDEQ will continue to monitor activities at RML to ensure compliance with applicable air quality regulations (**Table 4-5**).

Class I Areas

The air modeling analysis conducted for RML predicted air emission would be within Montana and federal air quality standards. These emissions are not expected to visibly affect or modify air quality in Class I areas.

4.7.1.2 No Action

Emissions

Emissions would remain at current levels under the No Action Alternative (See **Table 4-5**).

4.7.2 Cumulative Effects

Under the Proposed Action, the minor increase in emissions would be added to emissions from the other 11 permitted sources in the county. A decrease in particulate matter emissions from reasonably foreseeable actions would occur as undeveloped areas are used for buildings and paved for parking. Since the Proposed Action would comply with ambient air quality standards, cumulative effects would be minimal.

4.8 WATER SUPPLY AND WASTEWATER

4.8.1 Direct and Indirect Effects

4.8.1.1 Proposed Action

Hamilton Water System

The CHDPW system is currently capable of producing a maximum of 2,350 gallons per minute (gpm). The highest production month in 2002 was July when an average of 1,786 gpm was produced (CHDPW 2002). This data indicates that there was about 560 gpm additional production capacity during the period of highest reported demand on the system (July 2002). A certain amount of water is lost through line leakage, recharging the shallow aquifer from which the groundwater is pumped. Assuming that 60 percent of this production capacity is lost to leaks in the Hamilton system, (see Water Supply section in Chapter 3), an

Table 4-5.
RML Emissions

Source	NOx		SOx		CO		PM_{10}		VOCs	
No Action Alternative (Existing) Emissions										
Incinerators (a)	0.8	tons/yr	0.7	tons/yr	0.8	tons/yr	1.6	tons/yr	2.6	tons/yr
	0.2	lbs/hr	0.2	lbs/hr	0.2	lbs/hr	0.4	lbs/hr	0.6	lbs/hr
Steam Generating	10.2	tons/yr	0.1	tons/yr	8.6	tons/yr	0.8	tons/yr	0.6	tons/yr
Boilers (a)	2.3	lbs/hr	0.0	lbs/hr	2.0	lbs/hr	0.2	lbs/hr	0.1	lbs/hr
Emergency Power	14.6	tons/yr	4.4	tons/yr	3.3	tons/yr	0.5	tons/yr	0.5	tons/yr
Generators	58.2	lbs/hr	17.7	lbs/hr	13.3	lbs/hr	2.0	lbs/hr	2.1	lbs/hr
Fuel Tanks	na		na		na		na		0.0	tons/yr
Preferred Alternative Emissions										
Incinerators (b)	1.2	tons/yr	1.1	tons/yr	1.2	tons/yr	2.3	tons/yr	4.0	tons/yr
	0.3	lbs/hr	0.3	lbs/hr	0.3	lbs/hr	0.5	lbs/hr	0.9	lbs/hr
Steam Generating	15.3	tons/yr	0.1	tons/yr	12.9	tons/yr	1.2	tons/yr	0.8	tons/yr
Boilers (b)	3.5	lbs/hr	0.0	lbs/hr	2.9	lbs/hr	0.3	lbs/hr	0.2	lbs/hr
Emergency Power	21.8	tons/yr	6.6	tons/yr	5.0	tons/yr	0.7	tons/yr	0.8	tons/yr
Generators	87.4	lbs/hr	26.6	lbs/hr	19.9	lbs/hr	3.0	lbs/hr	3.1	lbs/hr
Fuel Tanks	na		na		na		na		0.0	tons/yr
Potential to Emit (Maximum Permitted) Emissions										
Incinerators (c,d)	3.3	tons/yr	3.1	tons/yr	3.2	tons/yr	6.5	tons/yr	11.0	tons/yr
	0.8	lbs/hr	0.7	lbs/hr	0.7	lbs/hr	1.5	lbs/hr	2.5	lbs/hr
Steam Generating	42.4	tons/yr	0.3	tons/yr	35.6	tons/yr	3.2	tons/yr	2.3	tons/yr
Boilers (c)	9.7	lbs/hr	0.1	lbs/hr	8.1	lbs/hr	0.7	lbs/hr	0.5	lbs/hr
Emergency Power	60.4	tons/yr	18.4	tons/yr	13.7	tons/yr	2.1	tons/yr	2.1	tons/yr
Generators (e]	241.6	lbs/hr	73.5	lbs/hr	55.0	lbs/hr	8.2	lbs/hr	8.6	lbs/hr
Fuel Tanks	na		na		na		na		0.0	tons/yr

Note: NOx = nitrogen oxides; SOx = sulphur dioxides; CO = carbon monoxide; PM_{10} = particulate matter < 10 microns; VOCs = volatile organic compounds; lbs/hr = pounds per hour; tons/yr = tons per year; na = not applicable

(a) Based on actual facility natural gas usage March 2002 to February 2003: 204 million cubic feet/yr of natural gas
(b) Based on a 50% increase in fuel needs over existing usage
(c) Permit conditional limit of 847 million cubic feet/yr of natural gas
(d) Permit conditional limit of 3504 tons/yr
(e) Permit conditional limit of 500 hours/yr

Source: MDEQ 2003 (Potential to Emit)

additional capacity of about 226 gpm is available for new customers.

The number of employees at RML is expected to increase by approximately 30 percent with the completion of the Integrated Research Facility.

Water consumed at RML is used for drinking water, research experiments, sewage, and industrial process such as boiler water. Work that would be performed at the Integrated Research Facility would be similar to work performed elsewhere on the RML campus. Therefore, experimental, drinking water, and sewage uses may be expected to increase commensurate with the increase in workers. A new boiler is planned as part of the Integrated Research Facility construction so there would also be an increase in industrial usage. Based on this information, and Hemisphere's (2003) estimated current water usage for RML of 56,000 gallons per day, water consumption at RML would increase by up to 30 percent to about 73,000 gallons per day (an increase of about 17,000 gallons per day or 12 gpm) if the Integrated Research Facility were constructed. This compares with Hemisphere's (2003) estimate of 15,000 gallons per day of effluent from the Integrated Research Facility.

The estimated increase of 17,000 gallons per day represents about a one percent increase in the amount of water distributed by the CHDPW on a daily basis. With respect to available capacity, the Integrated Research Facility would use about 5.3 percent (12 gpm of 226 gpm) of system capacity. Increased demand for water created by operation of the Integrated Research Facility would have a minor impact on the CHDPW municipal water supply system, and the system would be able to handle the increased demand, even with an assumed leakage of 60 percent.

Section 4.2.1.1 estimated that 100 new employees would be added at the facility by 2006 and that households in Ravalli County have an average of 2.45 residents per household. Assuming that thirty percent of the new employees live in Hamilton, and assuming each household has 2.45 people, 30 new households having 75 new residents would result from employment at the Integrated Research Facility. If each person uses an average of 150 gallons per day, there would be an average increased daily usage of 11,250 gallons per day per household. Assuming that all 30 new households are single-family dwellings on half-acre lots and use an average of 1,305 gallons per day to irrigate lawns for 120 days per year, the average amount of water used per household for irrigation would be 12,871 gallons per day. If the estimated increase usage from RML is added to the new resident usage and irrigation, the total increase would be 41,121 gallons per day, or 28.5 gpm during the irrigation season. This would increase the daily quantity of water sold by the CHDPW by about six percent. The existing Hamilton water supply system can adequately supply water for the Integrated Research Facility and water for irrigation and other household purposes for 30 new households. Even if all the new employees chose to live in the service area of the water system, the amount of increased water usage is estimated at 55 gpm, or roughly 24 percent of the available capacity of 226 gpm.

Groundwater

Section 3.8 of Chapter 3 provides an estimate of the amount of water available in the shallow aquifer below Hamilton on a daily basis. An increased use of 17,000 gallons per day by the Integrated Research Facility is estimated to be 0.2 percent of the water available in the portion of the aquifer supplying Hamilton on a daily basis. An increase of 41,121 gallons per day (Integrated Research Facility, households, and irrigation) represents about 0.6 percent of the amount available in the limited portion of the aquifer supplying Hamilton on a daily basis. Therefore, the Proposed Action would depreciate the amount of groundwater available on a daily basis (daily flux in the aquifer) by less than 1.0 percent.

The estimate of aquifer yield clearly shows that groundwater supply is not a limiting factor with respect to construction of the Integrated Research Facility, and the estimate is conservative for several reasons. There is considerably more groundwater flowing beneath the Hamilton area than the calculations shown in Chapter 3, Section 3.8, account for. There are reportedly up to 2,400 feet of unconsolidated sediments underlying the shallow aquifer in Hamilton (USGS 2000). These are ancestral Bitterroot River Deposits that form another aquifer beneath the aquifer currently supplying water to Hamilton. This deeper aquifer contain a larger quantity of groundwater than the shallow aquifer that is currently being utilized. There are also unconsolidated sediments west of the Bitterroot River that are a source of water for many residences west of the river. Hamilton does not currently use these groundwater sources but could in the future, if needed.

Wastewater Treatment

Wastewater discharge at RML would increase the average load by about 17,000 gallons per day (Hemisphere 2003) to about 73,000 gallons per day upon completion of the Integrated Research Facility. The CHDPW wastewater treatment plant is currently operating below design capacity in terms of average and peak flow per day. New homes built in Hamilton as a result of new employees moving to the area would increase this further. An increase of 15,000 gallons per day of effluent from RML would use some of the additional plant capacity, but would not require an upgrade to provide additional treatment capacity. This compares with Hemisphere's (2003) estimate of 15,000 gallons per day of effluent from the Integrated Research Facility.

Solids removed from the effluent stream are collected as sludge and stored. The CHDPW has reached its solids handling capacity, and the city of Hamilton is planning to construct a temporary solids storage basin to meet current requirements in the interim until a facility expansion plan is prepared (HDR 2003). The CHDPW would need to upgrade solids handling capacity even if the Integrated Research Facility were not built.

The estimated volume of solids in RML's current wastewater stream is small relative to the volume of liquid (Lowry 2003). New operations at the Integrated Research Facility would increase the solids load in wastewater from RML. Based on concentration and solids volume data (Hemisphere Engineering 2003b) for wastewater leaving the Integrated Research Facility, the additional solids produced at the CHDPW as a result of the Proposed Action would be approximately 28 pounds per day, or 10,183 pounds per year. The amount of solids in Integrated Research Facility effluent was estimated using the following calculation from Metcalf and Eddy (1991):

$$M_{Solids} = Q_{Inf.} \times [(BOD_{RMLeff.} - BOD_{CHDPWeff.}) \times NVF + (TSS_{RMLeff.} - TSS_{CHDPWeff})] \times 8.34$$

Where:

M_{Solid} = Mass of removable solids in pounds (lbs)

$Q_{Inf.}$ = Flow rate from RML in million gallons per day (0.015 MG/day)

$BOD_{RMLeff.}$ = Biological Oxygen Demand in RML wastewater (200 mg/L)

$BOD_{CHDPWeff.}$ = BOD limit in CHDPW effluent (10 mg/L)

NVF = nonvolatile fraction of BOD (70%)

$TSS_{RMLeff.}$ = Total Suspended Solids in RML wastewater (100 mg/L)

$TSS_{CHDPWeff.}$ = TSS limit in CHDPW effluent (10 mg/L)

8.34 = conversion factor [(lbs/MG)/(mg/l)]

Approximately 1,000 to 1,200 pounds of solids per day are currently handled at the CHDPW. (Lowry 2003). The 28 pounds of additional solids generated by the Integrated Research Facility represents a 2.3 to 2.8 percent increase in solids load to the CHDPW wastewater facility.

The Proposed Action would not have an impact on the solids handling capacity at the CHDPW because the planned upgrade of the solids handling capacity at the facility would accommodate current and future needs of Hamilton as well as additional solids produced by the Integrated Research Facility.

4.8.1.2 No Action

Hamilton Water System

The No Action Alternative would not have an impact on water supplies in Hamilton or the Bitterroot Valley.

Groundwater

The No Action Alternative would not have an impact on the water source in Hamilton or the Bitterroot Valley based on the estimate of aquifer yield provided in Chapter 3, Section 3.8.

Wastewater

The No Action Alternative would not have an impact on wastewater treatment in Hamilton. The No Action would not have an impact on the solids handling capacity of the plant.

4.8.2 Cumulative Effects

Hamilton Water System

Corixa Corporation operates a private laboratory northeast of Hamilton and is planning to expand the facility beginning in 2003. This expanded facility will receive water from CHDPW. CHDPW anticipates the Corixa facility will require an average of 50,000 gallons per day (35 gpm) of water from the system (Lowry 2003).

The total increased water usage from the Integrated Research Facility, new households (irrigation and non-irrigation), and Corixa's facility is estimated at 539,628 gallons per day, or 374 gallons per minute. This would increase CHDPW current distribution of water by approximately 8.5 percent, and exceed the current availability of municipal system (226 gpm). However, the potential cumulative effects on the Hamilton Water System are tempered by planned upgrades to the municipal water supply to offset anticipated increases in demand for water. CHDPW plans to bring three new water supply wells on-line to supply an additional 2,500 gpm (Lowry 2003). They also plan to abandon two existing wells that are currently in poor condition that produce a combined 1,300 gpm. The planned upgrades to the system would provide a net gain in production capacity of about 1,200 gpm, more than the cumulative demand on the system of 374 gpm.

Several conservative assumptions were also used in estimating the cumulative demand on the system, including:

- The highest estimated influx of people (18,000 persons) to the area would occur by 2010;
- Ten percent of those relocating to Ravalli County would live in Hamilton. This was based on the current statistics at the Ravalli County Chamber of Commerce;
- Each person uses 150 gallons per day of water;
- New residents live in households with 2.45 residents each;
- Half of the households are multifamily units using minimal irrigation, and the other half are single-family dwelling residences on half-acre lots that use an average of 1,305 gallons per day to irrigate lawns;
- Irrigation season is 120 days per year; and
- Sixty percent of water produced by the system is unaccounted for, leaking out of supply lines.

The increases realized by installing new wells and repairing leaks would provide adequate capacity to supply the increased demand of RML, Corixa, and new homes.

Groundwater

If there is an increased cumulative demand on the Hamilton municipal system of 539,628 gallons per day (see estimate above), approximately 19 percent of the daily amount of groundwater available (flux) in the shallow aquifer beneath Hamilton would be used. (See calculations in Chapter 3, Section 3.8). The underlying aquifer is capable of providing a sufficient amount of groundwater for the projected cumulative demand.

Wastewater

The expanded Corixa facility would be connected to the CHDPW wastewater system (Lowry 2003). CHDPW anticipates that the Corixa facility would discharge approximately 50,000 gallons per day of effluent to the sanitary sewer system. New homes and businesses would be built in the Hamilton area that will be connected to the CHDPW wastewater system. It is possible that within this period, the current wastewater treatment plant would need to be expanded to increase the capacity to treat combined increase in effluent coming from the Proposed Action, Corixa's facility, and new home and business construction. It is also possible that CHDPW wastewater treatment plant would need to be expanded under the No Action alternative due to combined discharges of Corixa's facility and new home and business construction.

Because the solids handling capacity of the wastewater plant would be expanded, reasonably foreseeable activities are not expected to have an impact on the solids handling capacity of the plant.

4.9 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse effects are undesirable effects that cannot be avoided if the Proposed Action or any alternative is implemented.

No unavoidable adverse effects have been identified from implementation of the Proposed Action.

4.10 RELATIONSHIPS BETWEEN SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY

Short-term uses associated with the Proposed Action would result in construction and operation of an Integrated Research Facility on the RML campus where other laboratories and office buildings currently exist. Land where the Integrated Research Facility is proposed to be built would be obligated for the duration of the need for the laboratory structure. No action taken in the construction and operation of this facility would preclude returning the land to its current status or to another use in the future.

Continued and future research at RML would have the potential to maintain long-term productivity because of opportunities to develop vaccines, diagnostics, and treatments to control or avoid the effects of infectious disease outbreaks in the world community. Control or avoidance of these effects would result in increasing the productivity and lives of people throughout the world.

4.11 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources associated with the energy (e.g., electricity, natural gas, fossil fuels) and building materials (e.g., copper wire and piping, brick, steel, concrete, glass, aluminum and other metals) used to build and operate the facility is expected to result from implementation of the Proposed Action. Commitment of these resources could not be reversed, although some materials may be recycled and reused.

An irretrievable commitment of resources would occur from the use of wood in building materials and change in land use for the Integrated Research Facility. Commitment of these resources would be reversible in the long term (beyond 100 years).